4.2 Bubble Chamber CF_3I Drain Procedure

This procedure covers the removal of CF_3I from the bubble chamber inner vessel.

1) Review procedure 3 "CF_3I Handling Procedure".

2) Ensure that the hydraulic system is appropriately initialized. It should be pressurized, with the inner vessel near full extension. It's temperature should be between 20°C and 30°C .

3) Ensure that the CF_3I transfer bottle is sufficiently large to contain all the CF_3I to be drained.

4) Assemble the CF_3I transfer lines, vacuum pump, and the CF_3I transfer bottle. An empty CF_3I bottle is preferred over a residue bottle when the cleanliness of the gas and inner vessel must be maintained. The plumbing consists of a flexible connection from the main Cartan valve (MV-22) to the CF_3I transfer bottle. No filter is required. The line is equipped with a tee to a vacuum gauge, an isolation valve, and a vacuum pump. Place the CF_3I transfer bottle in a cooling bath of either ice water or chilled water.

5) If the CF_3I bottle does not contain residue, open the port to the transfer bottle. Check that the transfer line pressure is less than 30psia. Ensure MV-22 is closed. Turn on the vacuum pump, open the plumbing to the vacuum pump and evacuate the CF_3I transfer lines and bottle (if applicable). Once they are evacuated, isolate and turn off the vacuum pump. Record the vacuum pressure, wait 5 minutes, and re-check the vacuum pressure. Repeat the vacuum check with the transfer bottle valve closed. Ensure there are no leaks.

6) Ensure that you have the "Commissioning Tool" VI operating. This software will provide access to and logging of all of the state variable data for the chamber, the CF_3I mass transfer data, the control and read-back data from the hydraulic cart and the heater/chiller unit, and photography data for the inner vessel.

7) Initiate data logging every 5 seconds.

8) Use the hydraulic piston position controls to drive the fast piston down to near its bottom stop and to extend the bellows. Be very careful not to overextend the bellows.

9) Follow the "Before Handling CF_3I" section of procedure 3.

10) Verify that the vacuum pump line is closed. Very slowly open MV-22 to initiate the distillation. Around 75psi of pressure will now fill the line. The CF_3I will boil through the water. Make sure that the inner vessel does not crash against it's

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upper stop. If it moves hard towards the stop, **DO NOT adjust the hydraulic piston position**. Close MV-22 slowly and stop the distillation. A lower inner vessel temperature will have to be selected.

11) Allow the distillation to proceed until no more CF_3I remains.

12) Wait for the transfer line pressure to fall below 30psia, then move the hydraulic ram down to place the inner vessel near it's upper stop. Do not allow the hydraulic pressure to rise more than a few psi.

13) When the transfer line pressure stabilizes at a minimum, close MV-22 and isolate the transfer bottle.

14) Move the hydraulic ram up to bring the inner vessel to near neutral bellows.

15) Vent the transfer line and disconnect it from both the inner vessel and the transfer bottle. Cap the transfer bottle and the inner vessel port.

16) Ensure the "After Handling CF_3I" section of procedure 3 was followed.

17) Terminate data acquisition and backup the data by rsync'ing with the coupp2ls1 data disk.